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Changes in Characteristics of Women Who Smoke During Pregnancy: Missouri, 1978-88

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Synopsis

The Missouri birth certificate has had a question, "cigarettes smoked per day?" since 1978; the current data base contains more than 800,000 records. A comparison of the Missouri data for married mothers with the National Natality Survey (NNS) data shows mainly consistent findings between the two data sets. The Missouri data, however, also provided information on the smoking status during pregnancy of unmarried women that is not available from the NNS.

The Missouri data show a substantial difference in

the smoking rates of married (23.2 percent) and unmarried (40.9 percent) women. The highest smoking rates during pregnancy are found among unmarried women, ages 20-24, with less than a high-school education, and those with a fourth or higher order child.

There has been a relatively small overall drop in the smoking rate from 1978-80 to 1986-88 (31.1 percent versus 27.5 percent). However, blacks and teenagers have had very substantial drops in smoking rates. There has been only a slight decrease for other high-risk groups such as white unmarried women, women with less than a high-school education, and those having a fourth or higher order birth.

Missouri started using the new national standard birth certificate in 1989 with a differently worded smoking question. The percentage of women smoking and those smoking less than one pack per day in 1989 went down more than would be expected from the trend data. It appears that the new birth certificate question will provide a lower estimate of the percentage of mothers who smoke cigarettes than was acquired from the previous version on the Missouri certificate. The births in Missouri for which mothers' rate of smoking was unknown increased nearly fourfold to 0.9 percent.

THE NEGATIVE relationship between prenatal cigarette smoking and birth weight was documented over 30 years ago by W. J. Simpson (1). Other hazards of cigarette smoking during pregnancy have since been documented including spontaneous abortion, growth retardation, perinatal mortality, and certain complications of pregnancy (2-9). Because of these risks, dif-

ferent agencies of the Public Health Service have initiated efforts to encourage pregnant women to stop smoking (10).

Several studies have reported on the characteristics of women in the United States who smoke during pregnancy (2, 3, 7, 9, 11-13). However, most studies are limited to a single year, a small population, or a popu-

lation limited to certain demographic characteristics. One of the major data bases with information on smoking during pregnancy is the National Natality Survey (NNS). This survey is a national sample of births that was last conducted in 1980. However, the 1980 NNS has a major limitation: it excludes unmarried mothers.

This paper compares Missouri data with the 1980 NNS, provides a description of who smokes during pregnancy on a statewide basis, and presents changes in the characteristics of the prenatal smoking population since 1978.

Methods

In 1978 Missouri was the first State to add to the standard certificate of birth and fetal death report the question "cigarettes smoked per day?" with checkoff boxes indicating none, less than one pack, and one pack or more. The smoking question has remained on the Missouri birth certificate since 1978.

The Missouri resident data base represents 833,375 live births for the 1978 to 1988 period. All birth records without information on smoking status were dropped from this study leaving 806,401 records (96.8 percent). Most of the incompleteness is attributable to births to residents that occurred in States that did not have a smoking question on the birth certificate. For births occurring in Missouri, the completeness rate was more than 99 percent. This high completeness rate contrasts with the 56 percent response rate for the 1980 NNS smoking item.

To provide a profile of who smokes while pregnant, we used 1986–88 certificates for live births. Three years of data were used to reduce the random fluctuation of small numbers. Changes in the characteristics of the prenatal smoking population were reviewed using Missouri resident live births occurring during the 1978–80 and the 1986–88 periods and reviewing the intervening years for consistency of trends. Data for the same two 3-year periods as noted previously were used to look at changes in the characteristics of the prenatal population smoking one or more packs per day.

A profile of who smokes while pregnant was developed using maternal race, age, education, marital status, and the infant's birth order. Race was defined as white or black, with black being composed of 94 percent black and 6 percent other nonwhite races. Age was divided into five categories: less than 20, 20–24, 25–29, 30–34, 35 or more; education, four categories: less than 12 years, 12, 13–15, 16 or more; marital status, two categories: married and unmarried; and birth order, three categories: first born, second or third, fourth or more.

In January 1989, Missouri changed to the new

Table 1. Demographic characteristics of mothers delivering live born infants in 1980, United States and Missouri

Category	Percent United States	Percent Missouri
Births to blacks	16.3	15.1
Births to teenagers	15.6	16.9
Births to mothers ages 35 and older	4.6	4.1
Births to mothers with less than 12 years of education	23.3	23.8
Births to unmarried mothers	18.4	17.6
Prenatal care started in third trimester	3.7	2.9

¹Excludes data for California, Texas, and Washington, which did not require reporting of educational attainment of mother. Marital status of mother is inferred using the 41 States and District of Columbia that report it on the birth certificate.

SOURCE: U.S. data acquired from Advance Report of Final Natality Statistics, 1980. National Center for Health Statistics, Vol. 31, No. 8, Supplement, Nov. 30, 1982.

Table 2. Percentage of married mothers who smoked during pregnancy and delivered live born infants, selected characteristics, United States and Missouri, 1980

Category	United States	Missouri		
	NNS	Married	Unmarried	Total
All mothers	26.3	27.3	47.4	30.8
Race:				
White	27.0	27.4	54.9	30.0
Black	20.9	25.9	41.4	35.3
Mother's age:				
Less than 20 years	40.0	41.1	42.4	41.7
20–24 years	31.8	31.2	51.7	34.9
25–29 years	21.3	21.2	50.2	23.6
30–34 years	19.2	22.1	49.2	23.9
35 and more years	20.8	25.4	57.4	28.0
Education:				
Less than 12 years	43.8	51.5	52.9	52.0
12 years	28.1	27.6	43.9	29.9
13–15 years	20.1	18.0	36.9	20.1
16 and more years	10.3	9.8	22.1	10.0

¹Significantly different from the National Natality Survey (NNS).

SOURCE: 1980 NNS information represents weighted national estimates of maternal smoking during pregnancy; data were produced by the Natality Statistics Branch, Division of Vital Statistics, National Center for Health Statistics.

national standard live birth-fetal death certificate, which includes an item on smoking. The new certificate has two smoking-related questions: "tobacco use during pregnancy?" with yes and no checkoff boxes and "average number of cigarettes per day?" with a place to put the number. A comparison of information obtained with our old certificate was made to determine if differences in how smoking status is asked affects results.

Results

Smoking data, Missouri versus 1980 NNS. Table 1 shows that demographic characteristics of Missouri

Table 3. Percentage of mothers who smoked during pregnancy and who delivered live born infants, by marital status, race, and selected characteristics: Missouri, 1986–88

Category	Total (N = 60,168)	Married			Unmarried		
		Total (N = 38,685)	White (N = 36,610)	Black ¹ (N = 2,075)	Total (N = 21,483)	White (N = 13,862)	Black ¹ (N = 7,621)
Total	27.5	23.2	23.6	17.7	40.9	50.6	30.3
Mother's age (years):							
Less than 20	30.0	32.2	33.0	14.4	28.7	41.1	13.9
20–24	33.3	28.8	29.6	17.0	44.2	55.3	32.6
25–29	26.3	22.1	22.4	18.8	53.5	60.2	46.7
30–34	20.6	17.4	17.3	18.1	50.6	54.7	46.5
35	20.0	16.8	16.9	16.0	47.6	48.3	46.9
Mother's education (years):							
Less than 12	48.6	50.2	51.5	30.8	47.2	58.1	33.4
12	29.6	27.0	27.4	20.7	38.0	46.9	29.1
13–15	19.0	16.9	16.9	17.0	31.2	37.2	26.3
16 or more	6.7	6.2	6.2	5.6	24.1	24.7	23.5
Birth order:							
First	23.2	19.5	20.0	10.7	31.9	42.1	16.2
Second or third	29.4	25.1	25.6	18.6	48.3	62.0	36.5
Fourth or more	35.6	27.9	28.1	26.7	56.1	66.1	51.0

¹Black includes all races other than white.

Table 4. Changes between 1978–80 and 1986–88 in the percentage of mothers who smoked during pregnancy, by selected maternal characteristics by race, Missouri residents

Category	1978–80			1986–88			Percent change		
	Total	White	Black ¹	Total	White	Black ¹	Total	White	Black ¹
Total	31.1	30.1	36.3	27.5	27.7	26.3	– 11.6	– 8.0	– 27.5
Mother's age (years):									
Less than 20	42.4	44.7	36.0	30.0	37.0	13.9	– 29.2	– 17.2	– 61.4
20–24	34.2	32.9	40.9	33.3	34.4	28.8	– 2.6	+ 4.6	– 29.6
25–29	24.3	23.2	32.9	26.3	25.3	33.1	+ 8.2	+ 9.1	+ 0.6
30–34	24.7	23.9	30.2	20.6	19.4	30.0	– 16.6	– 18.8	– 0.7
35 or more	28.6	28.2	31.0	20.0	18.9	27.6	– 30.1	– 33.0	– 11.0
Marital status:									
Married	27.6	27.7	26.5	23.2	23.6	17.7	– 15.9	– 14.8	– 33.2
Unmarried	48.0	55.0	42.5	40.9	50.6	30.3	– 14.8	– 8.0	– 28.7
Education (years):									
Less than 12	51.6	53.7	44.9	48.6	54.1	33.1	– 5.8	+ 0.7	– 26.3
12	29.7	28.9	35.5	29.6	30.2	26.7	– 0.3	+ 4.5	– 24.8
13–15	20.8	19.4	28.4	19.0	18.5	21.7	– 8.7	– 4.6	– 23.6
16 or more	10.5	10.4	11.9	6.7	6.5	8.5	– 36.2	– 37.5	– 28.6
Birth order:									
First	29.7	29.5	31.1	23.2	24.7	14.8	– 21.9	– 16.3	– 52.4
Second or third	31.4	30.1	39.0	29.4	29.3	30.0	– 6.4	– 2.7	– 23.1
Fourth or more	35.7	33.7	41.9	35.6	33.0	42.5	– 0.3	– 2.1	+ 1.4

¹Black includes all races other than white.

mothers delivering in 1980 are very similar to those for the United States for the same year. Table 2 shows that the smoking rates are very similar for the two data sets for married mothers. This similarity of the two data sets supports the validity of smoking data collected by the birth certificate. Married mothers who have the highest smoking rates—that is, the largest percentages who smoked—during pregnancy are most likely to be white, less than 25 years, and have less than a high school

education. However, examination of Missouri smoking patterns by marital status reveals a different picture.

Marital status and smoking. Table 3 shows that the smoking rate for unmarried mothers was more than 75 percent higher than the corresponding rate for married mothers for the 1986–88 period. The increased percent of unmarried mothers who smoked is consistent for most of the demographic characteristics presented,

although to varying degrees. Little differences in smoking rates by marital status are found for teenagers and those with less than a high school education. Greater differences are found among white mothers than among black mothers. Unmarried black teenage mothers with less than a high school education have a lower smoking rate, 13.9 percent, than their married counterparts, 14.4 percent.

The highest smoking rates for unmarried mothers, like their married counterparts, are observed for white mothers. The two groups are different in that the smoking rate for unmarried mothers increases with increasing age to a peak at 25–29 and then declines for ages 30 and older; whereas for married mothers the smoking rate is inversely related to age.

Table 3 also shows that marital status has a stronger relationship than race with whether a mother smokes. The overall smoking rate—regardless of marital status—for black mothers is 5 percent below the corresponding rate for white mothers, 26.3 and 27.7 percent, respectively. The highest smoking rates occur among unmarried white mothers followed by unmarried black mothers. Married black mothers have the lowest smoking rate. These patterns hold true for most age, education, and birth order groups.

There is a strong relationship between the smoking rate and level of maternal education. The relationship is strongest for married mothers. There is an eightfold difference between the smoking rate of white married mothers with less than 12 years of education and college graduates. Married black mothers have nearly a sixfold difference in smoking rates for those educational extremes. Unmarried mothers also show smoking rate differences by education but not as great as their married counterparts.

The group of mothers with the largest proportion of smokers are unmarried whites having a fourth or higher order birth. About two of three women with these characteristics smoke during pregnancy. The lowest rate is found among black married mothers with a college education. Less than 6 percent of these women smoke during pregnancy.

Trends in smoking behavior during pregnancy. The percentage of women who smoked during pregnancy declined 11.6 percent from 1978–80 to 1986–88 (table 4). The corresponding decline for black mothers was 27.5 percent and 8.0 percent for white mothers. In 1978–80 the black mothers' smoking rate of 36.3 percent was higher than the 30.1 percent for whites. With the substantial drop for blacks and little change in the white rates, the rate for black women who smoked during pregnancy is now lower than that for whites (26.3 compared with 27.7 percent).

Figure 1. Percentage of black mothers who smoked during pregnancy and delivered live born infants, by age group, Missouri residents, 1978–88

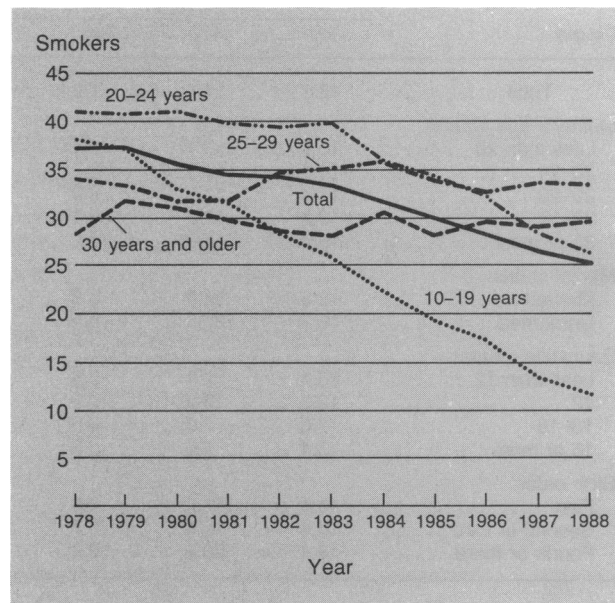
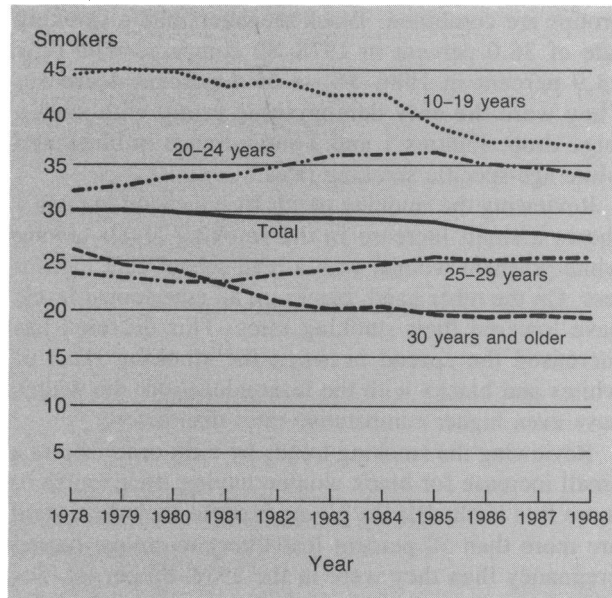


Figure 2. Percentage of white mothers who smoked during pregnancy and delivered live born infants, by age group, Missouri residents, 1978–88



A smaller percentage and fewer teenage mothers are smoking during pregnancy as well as a smaller percentage of women aged 30 or more. However, a greater percentage and more women 25–29 are smoking during pregnancy. The increase in women ages 25–29 who smoke during pregnancy and the decrease in women ages 30 or more who smoke parallel the smoking pat-

Table 5. Percentage of mothers smoking one pack of cigarettes or more per day during pregnancy by selected maternal characteristics by race, Missouri resident births, 1978–80 and 1986–88

Category	1978–80			1986–88			Percent change		
	Total	White	Black ¹	Total	White	Black ¹	Total	White	Black ¹
Total	13.1	14.1	7.6	10.8	11.9	4.9	–17.6	–15.6	–35.5
Mother's age (years):									
Less than 20	13.7	17.1	4.3	9.2	12.6	1.3	–32.8	–26.3	–69.8
20–24	14.2	15.3	8.7	12.5	14.4	4.2	–12.0	–5.9	–51.7
25–29	11.4	11.7	8.9	10.9	11.5	7.1	–4.4	–1.7	–20.2
30–34	12.2	12.6	9.4	9.1	9.3	8.1	–25.4	–26.2	–13.8
35 or more	15.4	16.3	10.0	9.5	9.8	7.7	–38.3	–39.9	–23.0
Marital status:									
Married	12.3	12.8	6.2	9.6	10.0	3.4	–22.0	–21.9	–45.2
Unmarried	16.7	27.0	8.5	14.5	22.7	5.6	–13.2	–15.9	–34.1
Education (years):									
Less than 12	23.4	27.8	9.6	21.3	26.3	6.7	–9.0	–5.4	–30.2
12	12.3	13.0	7.2	11.3	12.6	4.6	–8.1	–3.1	–36.1
13–15	7.6	7.9	6.0	6.4	6.9	3.8	–15.8	–12.7	–36.7
16 or more	3.4	3.5	2.2	2.0	2.0	1.8	–41.2	–42.9	–18.2
Birth order:									
First	10.4	11.5	4.3	7.5	8.6	1.8	–27.9	–25.2	–58.1
Second or third	14.4	15.4	8.7	12.3	13.6	5.4	–14.6	–11.7	–37.9
Fourth or more	18.4	20.2	12.9	16.6	18.9	10.6	–9.8	–6.4	–17.8

¹Black includes all races other than white.

terns of all women that have been documented by the National Health Interview Surveys (NHIS) (12).

The substantial drops in smoking rates among blacks and teenagers is even more dramatic when these two groups are combined. Black teenagers had a smoking rate of 36.0 percent in 1978–80 compared with only 13.9 percent in 1986–88—a 61.4 percent decrease. They were the only demographic group with such a large drop. Figures 1 and 2 show trends in black and white age-specific smoking rates.

Reviewing the smoking trends by education in table 4 shows a small increase in the smoking levels among white pregnant women with a high-school education or less. On the other hand, blacks on all educational levels have lowered their smoking rates. This decrease has increased the spread between the smoking rates of whites and blacks with the least education; the whites have even higher comparative rates than before.

Reviewing the smoking trends by birth order shows a small increase for black women having their fourth or more live birth. Blacks giving birth to their first child are more than 50 percent less likely to smoke during pregnancy than they were in the 1978–80 period. For whites, there was a decrease in the rate of smoking for all birth orders, with the greatest occurring for first born. Pregnant women with the highest smoking rates in 1978–80 were blacks, teenagers, unmarried mothers, those with less than 12 years education, and mothers having a fourth or higher order birth. The smoking pattern in the late 1980s shows two substantial changes. Smoking rates for blacks are now lower than for whites,

and teenagers' smoking rates are lower than the 20–24 age group. Unmarried mothers, mothers with less than 12 years of education, and mothers with four or more children continue to have high smoking rates.

Trends in heavy smoking during pregnancy. Studies (1–3, 7, 14, 15) including those using Missouri data (2) have shown that there is an inverse dose response relationship between the number of cigarettes smoked and mean birth weight. The studies (2–3, 7) also show a positive dose-response relationship between the number of cigarettes smoked during pregnancy and the percent of babies born with low birth weight (that is, less than 5 pounds, 8 ounces).

Table 5 shows the percentages of pregnant women by different maternal characteristics who smoked one or more packs of cigarettes per day for 1978–80 and 1986–88. Generally those groups that have high proportions of smokers also are the heaviest smokers. Whites are 2.4 times more likely to be heavy smokers during pregnancy than blacks. Whites are more apt to be heavy smokers than blacks regardless of which other demographic characteristics are reviewed. For white mothers, the heavy smoking rate peaks at ages 20–24; however, for black mothers, the heavy smoking rate increases with age, peaking at ages 30–34. Decreases between the two periods studied were observed for all age groups for both races, with the greatest decreases for blacks younger than 25 years of age and for whites older than 34.

The highest rate of heavy smoking (32.4 percent—

not shown) was found for whites older than 19 with less than a high school education. Patterns for rates of heavy smoking by education are the same as noted for smoking. However, there have been decreases in heavy smoking rates during pregnancy for all educational levels. Heavy smoking during pregnancy has dropped more than one-third for blacks but by less than one-sixth for whites.

Changes in behavior versus demographic changes.

In order to see what part, if any, of the decrease in smoking among pregnant women was related to change in behavior rather than changes in the distribution of births, the demographic characteristics were controlled using the direct method of standardization (16). The rates were adjusted using education, age, marital status, birth order, and race with the mid-year 1983 used as the standard population. More than 93 percent of the reduction in the rate of smoking during pregnancy rate between 1978 and 1988 was found to be attributable to changes in smoking behavior rather than changes in the distribution of births.

Comparison of old and new birth certificates. Missouri, along with most States, adopted the national model standard birth certificate in 1989. The standard certificate has a differently worded question asking about smoking than that on the 1978-88 certificates. The smoking data from the 1989 birth certificates were examined to determine how the change in wording may have affected Missouri data, and how the new wording may affect other States. Table 6 shows that the percent of births to mothers smoking during pregnancy decreased from 26.9 percent for 1988 to 25.9 percent for 1989 provisional birth data (recorded on the new birth certificate). The data are based upon Missouri women who gave birth in Missouri.

Ninety-three percent of the reduction in the smoking rate between 1988 and 1989 was due to those smoking less than one pack per day. This indicates that most who indicate that they smoke, but do not know how much, probably smoke less than one pack per day. The percentage of 1989 certificates noting unknown tobacco usage was 0.32 percent (240 persons) with an additional 0.59 percent (422 persons) noting an unknown amount of cigarettes per day. The overall rate for unknown amount of cigarettes smoked per day during pregnancy increased from 0.24 percent for 1988 to 0.91 percent in 1989.

Discussion

The 1980 NNS and 1980 Missouri smoking data for married women compare favorably. The U.S. weighted

Table 6. Comparison of data on tobacco use reported on old and new birth certificates, Missouri resident births recorded in Missouri, 1988, 1989¹

Category	1988		1989	
	Number	Percent	Number	Percent
Total	74,054	...	75,158	...
Tobacco use unknown	175	0.24	240	0.32
Average number of cigarettes per day unknown (includes tobacco use unknown)	175	0.24	682	0.91
Smoke less than 20 cigarettes (< 1 pack)	12,249	16.6	11,352	15.2
Smoke 20 cigarettes or more (≥ 1 pack)	7,606	10.3	7,588	10.2
Smoke without regard to amount	19,855	26.9	19,382	25.9

¹1989 data are provisional.

²This percent is different from amount smoked because some certificates note that the mothers use tobacco without noting how much. If we just use those smoking one or more cigarettes regardless of how they answered "tobacco use during pregnancy?" then the smoking rate would be 25.4 percent (18,940 ÷ 74,476).

estimates for 1980 showed that 26.3 percent of the married women smoked during pregnancy as compared with 27.3 percent for Missouri. When comparing the United States and Missouri data by demographic characteristics, most of the smoking percentage differences are within two standard errors of the NNS estimate. The larger differences for black, older women, and less educated women possibly reflect NNS's low response rate problems. This explanation is strengthened by the consistency of the Missouri trend data. The consistency of the smoking trend data for maternal age as shown in figures 1 and 2 is also true for other variables. The consistency between the smoking data on the NNS and Missouri birth certificate validates the use of the birth certificate to collect smoking data.

Studies suggest that self-reported smoking behavior in surveys not directed at smoking cessation do provide a reasonable estimate of the true rate (17-19). Because of this, it is believed that the birth certificate provides a good means of acquiring information on smoking behavior during pregnancy.

Based upon a regression model using 1978 to 1988 data from the old certificate, the expected 1989 smoking rate was 26.5 compared to 25.4 using the new certificate. The expected and observed rates for smoking less than one pack were 16.5 and 15.2, respectively. These differences are statistically significant at the 0.05 level.

Changing to the new national birth-fetal death certificate resulted in a fourfold increase in the percentage of birth certificates reporting an unknown number of cigarettes smoked during pregnancy and is most likely because of the change in the way the information is acquired. First, changing to two questions from just one with the lead-in question asking "tobacco use during

pregnancy?" with yes and no checkoff boxes could cause more vagueness because smoking mothers may believe that others will perceive their behavior as being deviant. In such cases, it is better to have one "loaded" question that asks how much they smoke and give them the option of marking "none" (20). The second question asks the mother to give "average number of cigarettes per day?" with a place to put the number instead of providing ranges of smoked cigarettes. It is much easier for a person to respond to a range (for example, 1-9, 10-19 cigarettes per day) than it is for them to figure out an exact average number of cigarettes smoked per day. While the unknowns increased with the new certificate, the 99 percent response rate is still very high.

Overall, the percentage of women smoking during pregnancy has declined about 0.5 percent per year. The decline in smoking is mainly occurring among blacks, teenagers, and college educated women. Of special note is the dramatic decrease in smoking among black teenagers. On the negative side, white women ages 20-29 have increased their rate of smoking while pregnant. Because smoking has an adverse effect on pregnancy outcome and the mother's health, these results emphasize the need for more and better efforts directed at smoking cessation. Also, because the subgroups with the highest smoking rates are generally more apt than the general population to use public prenatal care clinics and the Supplemental Food Program for Women, Infants, and Children (WIC), public health has a responsibility to offer smoking cessation programs.

Missouri along with Colorado and Maryland, in collaboration with the Centers for Disease Control, is implementing a Smoking Cessation in Pregnancy (SCIP) Project in public prenatal clinics. The Missouri project will compare the effectiveness of a state-of-the-art intervention package to the cessation activities currently offered. Prenatal care clinics were randomized as intervention and control sites with the package for WIC intervention being used at all WIC agency sites. The intervention package will be offered to all prenatal clinics if it proves successful.

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